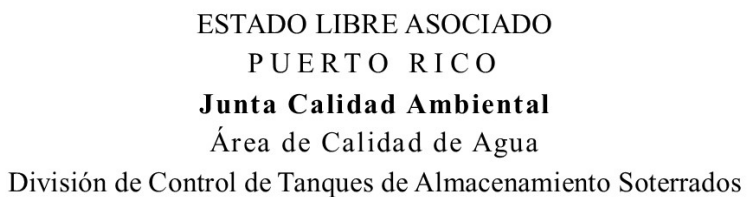


PARPCPTAS-001

MONITOREO DE AIRE

Se usará un AVO o PID

[illegible]

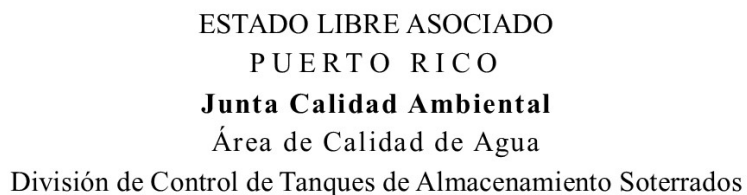


PARPCPTAS-002

Hoja de Conocimiento del Plan de Seguridad del Lugar

Por la presente certifico que he sido informado, he entendido y me acataré todos los procedimientos y protocolos establecidos por el Plan de Salud y Seguridad para el Proyecto

[illegible]



Hoja de Registro de Visitantes

Nombre del Proyecto:	Núm. UST:
Localización:	Gerente de Operaciones de Campo:
Gerente de Proyecto:	Oficial de Seguridad:

[illegible]



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PARPCPTAS-004

Personal de Agencias de Contacto En caso de emergencia

Contacto de Emergencia	Nombre de la Institución	Número de Teléfono
Agencia Estatal para el Manejo de Emergencias		
Bomberos		
Ambulancia		
Policía		
Unidad de Respuesta a Materiales Peligrosos		
Centro de Control de Envenenamiento		
Servicios Médicos en el lugar (onsite)	<input type="checkbox"/> Sí <input type="checkbox"/> No	N/A
Oficial de Salud y Seguridad		
Nombre		
Hospital		
Dirección		
Ruta al Hospital (explicar brevemente e incluir un mapa de la ubicación del hospital)		



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PARPCPTAS-005

**Equipo de emergencia
Disponible en el lugar**

Equipo de comunicación

	Teléfonos celulares
	Radio comunicadores
	Señales manuales
	Señales con banderas y letreros
	Alarmas o sirenas de emergencia

Equipo de monitoreo

	Medidor de porcentaje de oxígeno (Tipo instrumento:)
	Medidor de vapores COV (Tipo de instrumento:)
	Medidor de % LEL (Tipo de instrumento:)

Equipo médico

	Primeros auxilios
	Estación de lavado de ojos
	Ducha de emergencia
	Sábanas
	Camillas, etc.

Equipo contra incendios

	Extintores de fuego

Equipo Contra derrames

	Materiales absorbentes
	Absorbente seco o granulado
	Otros:

Equipo de seguridad adicional:



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PARPCPTAS-006

Informe de accidente

Nombre del Proyecto:

Núm. UST:

Localización:

Gerente de Proyecto:

Fecha:

Hora del accidente:

Yo presencié un accidente en el día de hoy en:

Lo siguiente es un recuento de lo que sucedió en el accidente:

Entiendo que esto pudo haber resultado en una lesión o daño:

☐ Personal

☐ Propiedad

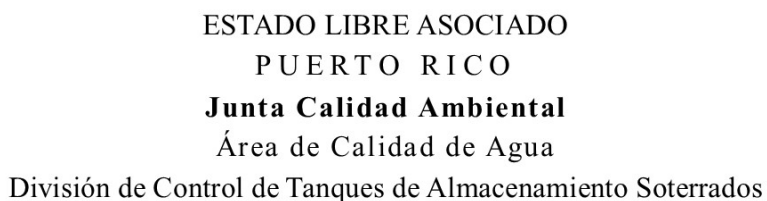
☐ Equipo

Si estas circunstancias ocurrieron, yo recomiendo las siguientes acciones para prevenir que esta situación ocurra de nuevo:

Estándar de seguridad requerido:

☐ SI (Aneje el estándar de seguridad)

☐ NO

[illegible]



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PARPCPTAS-008

Informe de Lesión/exposición

Nombre del Proyecto:	Núm. UST:
Localización:	Gerente de Proyecto:
Fecha:	Hora de la lesión:

Oficial de Salud y Seguridad:

INFORMACIÓN PERSONAL:	
------------------------------	--

Nombre del lesionado:	
Dirección:	
Cargo que ocupa:	
Edad:	
Sexo:	

CATEGORIA DEL ACCIDENTE:(vehículo de motor, fuego, daño a la propiedad, exposición química, otros (por favor explique)

--

GRADO DE SEVERIDAD DE LA LESION / EXPOSICION (no-incapacitante, incapacitante, tratamiento médico, fatalidad)
--

--

NATURALEZA DE LA LESION / EXPOSICION

--

CLASIFICACION DE LA LESION / EXPOSICION: (Favor verificar)

<input type="checkbox"/> FRACTURAS	<input type="checkbox"/> ULCERAS DE AGUA	<input type="checkbox"/> AGOTAMIENTO POR CALOR
<input type="checkbox"/> DISLOCACION	<input type="checkbox"/> QUEMADURAS POR CALOR	<input type="checkbox"/> ALERGIA DERMAL
<input type="checkbox"/> CALAMBRES	<input type="checkbox"/> QUEMADURAS POR RADIACION	<input type="checkbox"/> MAREOS
<input type="checkbox"/> ABRASIONES	<input type="checkbox"/> QUEMADURAS QUIMICAS	<input type="checkbox"/> ALERGIA RESPIRATORIA
<input type="checkbox"/> LACERACIONES	<input type="checkbox"/> PICADAS	

PARTE DEL CUERPO AFECTADA:

--

GRADO DE INCAPACIDAD:**FECHA EN QUE EL TRATAMIENTO MEDICO FUE RECIBIDO:****INFORMACION SOBRE LESION / EXPOSICION**

Agente causante más directamente relacionado con la lesión / exposición (objeto, sustancia, material, maquinaria, equipo, condiciones)

Fue el clima un factor?

Condición ambiental, mecánica, física al momento de la lesión / exposición (Especifique)

Factores personales (aptitud impropia, falta de conocimiento o destreza, reacción lenta, fatiga):

Nivel de equipo de protección personal especificado en el Plan de Salud y Seguridad

Medicamentos:

Estaba la persona lesionada utilizando el equipo de protección personal requerido?

Si no, como el equipo actual utilizado difiere del especificado en el Plan de Salud y Seguridad?

Qué se podrá hacer para evitar que este tipo de accidente no sea recurrente? (modificación de equipo, Cambios mecánicos, adiestramiento adicional, etc.)

Narre en detalle una descripción de la lesión / exposición. Cómo ocurrió? Por qué? Objetos, equipo, herramientas usadas, circunstancias, tareas asignadas, etc. (Especifique)

Testigos de la lesión / exposición (Nombres y testigos oculares)



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PARPCPTAS-009-1A

Certificación Recibo Plan de Muestreo

ACA 1-A

(Certificación a ser sometida para actividades de muestreo relacionado con cierres, rastreos y remediación, entre otros).

Esta certificación debe ser sometida en original junto a la solicitud de radicación para sistemas de Tanques de Almacenamiento Soterrados y copia de la misma someterla a la DFCP del ACA diez (10) días laborables **antes** de efectuarse la actividad de cierre.

Por la presente, yo _____ en mi carácter de _____ Del
(Nombre y apellidos) (Título o posición)

laboratorio _____ certifico que he recibido copia fiel y exacta del PARPCPTAS para Cierres
(Nombre del laboratorio)

De TAS de la JCA para el proyecto

(Número identificación)

_____, ubicado en _____ . Que
(Nombre de la empresa) (Dirección física)

las actividades incluidas en dicho PARPCPTAS en las cuales

(Nombre laboratorio)

tenga inherencia, serán efectuadas acorde con lo establecido en el mismo.

Firma

Sello/Número licencia (Si aplica)

(En caso de que la toma de muestras y los análisis de laboratorio sean realizados por diferentes entidades, cada una de las mismas deberá cumplimentar esta certificación).



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División de Control de Tanques de Almacenamiento Soterrados



PARPCPTAS-009-2A

Certificación Recibo

Plan de Muestreo

ACA 2-A

(Certificación a ser sometida para actividades de muestreo relacionado con cierres, rastreos y remediación, entre otros).

Esta certificación debe ser sometida en original junto a la solicitud de radicación para sistemas de Tanques de Almacenamiento Soterrados y copia de la misma someterla a la DICFP del ACA diez (10) días laborables **antes** de efectuarse la actividad de cierre.

Por la presente, yo _____ en mi carácter de _____

(Nombre y apellidos)

(Título o posición)

certifico que he recibido copia fiel y exacta del PARPCPTAS para Cierre de _____

(Nombre empresa)

TAS de la JCA para el proyecto _____

(Número identificación)

, ubicado _____ . Que
en _____

(Nombre de empresa)

(Dirección física)

las actividades incluidas en dicho PARPCPTAS en las cuales _____
(Nombre de empresa)

tenga inherencia, serán efectuadas acorde con lo establecido en el mismo.

Firma

Sello/Número licencia (Si aplica)

(En caso de que la toma de muestras y los análisis de laboratorio sean realizados por diferentes entidades, cada una de las mismas deberá cumplimentar esta certificación).



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PARPCPTAS-009-1B

Certificación Actividades de Muestreo

ACA 1-B

Esta certificación deberá ser completada y ser sometida en original junto con los resultados, Información de control de calidad y certeza de calidad y cualquier otro documento referente a las actividades efectuadas bajo el PARPCPTAS para Cierre de TAS de JCA.

Por la presente, yo

en mi carácter

de

(Nombre y apellidos)

(Título o posición)

de

certifico que he efectuado todas las actividades en las cuales

(Nombre empresa)

tenemos inherencia, incluidas en el PARPCPTAS para Cierre de TAS de la Junta de Calidad Ambiental

para el proyecto

(Número identificación)

,

(Nombre empresa)

, ubicado en

y que dichas actividades se hicieron en

(Dirección física)

Conformidad con el PARPCPTAS para Cierre de TAS de la JCA.

Firma

Sello/Número licencia (Si aplica)

(En caso de que la toma de muestras y los análisis de laboratorio sean realizados por diferentes entidades, cada una de las mismas deberá cumplimentar esta certificación).



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PARPCPTAS-009-2B

Certificación Actividades de Muestreo

ACA 2-B

Esta certificación deberá ser completada y ser sometida en original junto con los resultados,
Información de control de calidad y certeza de calidad y cualquier
otro documento referente a las actividades efectuadas bajo el PARPCPTAS para Cierres de TAS de JCA

Por la presente, yo

en mi

Del

carácter de

(Nombre y apellidos)

(Título o posición)

laboratorio

certifico que he efectuado todas las actividades en las

(Nombre del laboratorio)

cuales tenemos inherencia, incluidas en el PARPCPTAS para Cierre de TAS de la Junta de Calidad Ambiental

para el proyecto

,

, ubicado en

(Número

(Nombre empresa)

identificación)

y que dichas actividades se hicieron en

(Dirección física)

Conformidad con el PARPCPTAS para Cierre de TAS de la JCA.

Firma

Sello/Número licencia (Si aplica)

(En caso de que la toma de muestras y los análisis de laboratorio sean realizados por diferentes entidades, cada una de las mismas deberá cumplimentar esta certificación).



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PARPCPTAS-010

Certificación de Registros e Informes

Yo _____

Con el título o posición _____

En mi carácter de dueño u oficial de más alto rango en representación de la entidad o compañía _____

Ubicada en _____

Y registrada con el número del sistema de Tanques de Almacenamiento Soterrado (TAS):

UST-__ __-__ __ __ __ en la División de Protección de Aguas Subterráneas (DPAS) certifico que se utilizará el PARPCPTAS para Cierre de TAS de la Junta de Calidad Ambiental.

También certifico que todos los TAS y las líneas asociadas a ser instalados en este lugar (si aplica) serán construidos con doble pared y monitoria intersticial según requerido por el Acta Federal de Energía de 2005 (Energy Policy Act of 2005).

Además, en cumplimiento con la Regla 1002 del Reglamento para el Control de Tanques de Almacenamiento Soterrados, por la presente certifico que toda la información sometida en este documento y en todos los anejos es exacta, verídica y completa y que la misma ha sido expuesta sin intención de desvirtuar los hechos o de cometer fraude. Tengo conocimiento que de descubrirse cualquier falsedad o fraude estaré sujeto a penalidades de multas, encarcelamiento o ambas penas.

Nombre y apellidos

Firma

Compañía

Título o posición

Fecha



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PUERTO RICO

Junta Calidad Ambiental
Área de Calidad de Agua

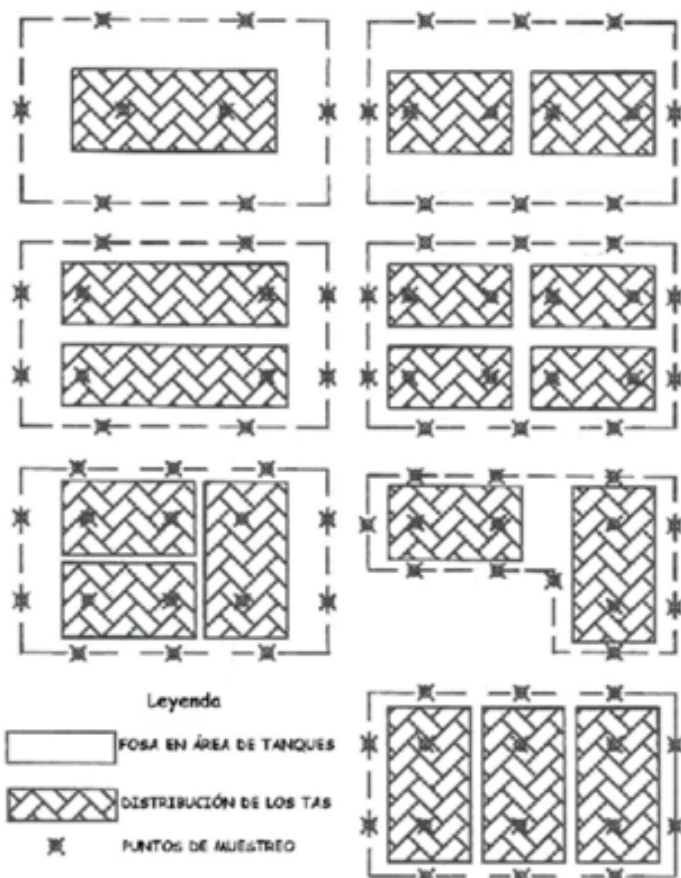
División de Control de Tanques de Almacenamiento Soterrados



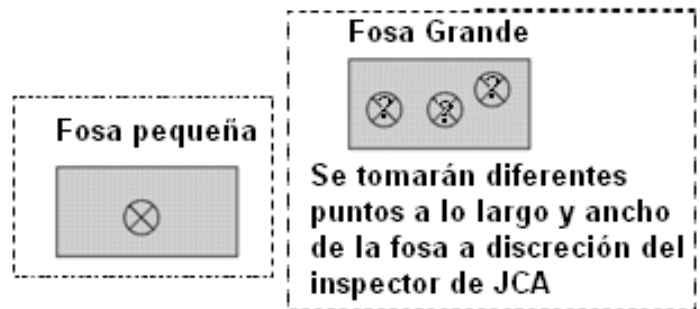
PARPCPTAS-011

Puntos de Muestreo durante cierre de tanques de almacenamiento soterrados

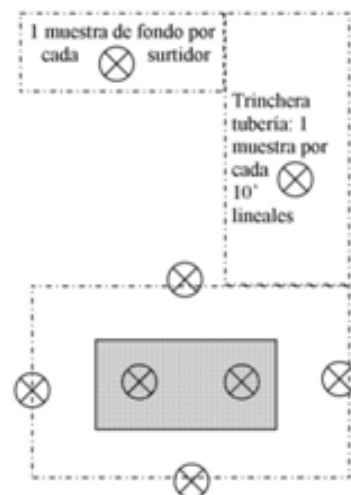
Esquema de muestreo para diferentes
distribuciones de TAS



Esquema para excavación con agua en el
fondo de la fosa



Esquema para trincheras de tubería de
distribución y surtidores



PARPCPTAS-012

[Construction](#) > [Construction Outreach TOC](#) > Excavations

**Construction Safety and Health
Outreach Program**

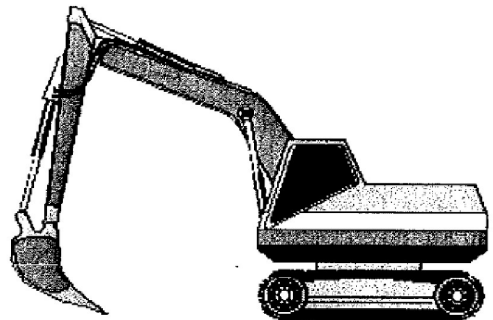
U.S. Department of Labor
OSHA Office of Training and Education
May 1996

Excavations

INTRODUCTION

The Occupational Safety and Health Administration (OSHA) issued its first Excavation and Trenching Standard in 1971 to protect workers from excavation hazards. Since then, OSHA has amended the standard several times to increase worker protection and to reduce the frequency and severity of excavation accidents and injuries. Despite these efforts, excavation-related accidents resulting in injuries and fatalities continue to occur.

To better assist excavation firms and contractors, OSHA completely updated the existing standard to simplify many of the existing provisions, add and clarify definitions, eliminate duplicate provisions and ambiguous language, and give employers added flexibility in providing protection for employees. The standard was effective as of March 5, 1990.



In addition, the standard provides several new appendices. One appendix provides a consistent method of soil classification. Others provide sloping and benching requirements, pictorial examples of shoring and shielding devices, timber tables, hydraulic shoring tables, and selection charts that provide a graphic summary of the requirements contained in the standard.

This discussion highlights the requirements in the updated standard for excavation and trenching operations, provides methods for protecting employees against cave-ins, and describes safe work practices for employees.

SCOPE AND APPLICATION

OSHA's revised rule applies to all open excavations made in the earth's surface, which includes trenches.

According to the OSHA construction safety and health standards, a *trench* is referred to as a narrow excavation made below the surface of the ground in which the depth is greater than the width-the width not exceeding 15 feet. An *excavation* is any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal. This can include excavations for anything from cellars to highways.

GENERAL REQUIREMENTS

Planning for Safety

Many on-the-job accidents are a direct result of inadequate initial planning. Correcting mistakes in shoring and/or sloping after work has begun slows down the operation, adds to the cost, and increases the possibility of an excavation failure. The contractor should build safety into the pre-bid planning in the same way all other pre-bid factors are considered.

It is a good idea for contractors to develop safety checklists before preparing a bid, to make certain there is adequate information about the job site and all needed items are on hand.

These checklists should incorporate elements of the relevant OSHA standards as well as other information necessary for safe operations.

Before preparing a bid, these specific site conditions should be taken into account:

- Traffic,
- Nearness of structures and their conditions,
- Soil,
- Surface and ground water,
- The water table,
- Overhead and underground utilities, and
- Weather.

These and other conditions can be determined by job site studies, observations, test borings for soil type or conditions, and consultations with local officials and utility companies.

Before any excavation actually begins, the standard requires the employer to determine the estimated location of utility installations—sewer, telephone, fuel, electric, water lines, or any other underground installations—that may be encountered during digging. Also, before starting the excavation, the contractor must contact the utility companies or owners involved and inform them, within established or customary local response times, of the proposed work. The contractor must also ask the utility companies or owners to find the exact location of the underground installations. If they cannot respond within 24 hours (unless the period required by state or local law is longer), or if they cannot find the exact location of the utility installations, the contractor may proceed with caution. To find the exact location of underground installations, workers must use safe and acceptable means. If underground installations are exposed, OSHA regulations also require that they be removed, protected or properly supported.

When all the necessary specific information about the job site is assembled, the contractor is ready to determine the amount, kind, and cost of the safety equipment needed. A careful inventory of the safety items on hand should be made before deciding what additional safety material must be acquired. No matter how many trenching, shoring and backfilling jobs have been done in the past, each job should be approached with the utmost care and preparation.

Before Beginning the Job

It is important, before beginning the job, for the contractor to establish and maintain a safety and health program for the work site that provides adequate systematic policies, procedures, and practices to protect employees from, and allow them to recognize, job-related safety and health hazards.

An effective program includes provisions for the systematic identification, evaluation, and prevention or control of general workplace hazards, specific job hazards, and potential hazards that may arise from foreseeable conditions. The program may be written or verbal but it should reflect the unique characteristics of the job site.

To help contractors develop an effective safety and health program, in 1989, OSHA issued recommended guidelines for the effective management and protection of worker safety and health. The complete original text of the nonmandatory guidelines is found in the *Federal Register* [54 FR (18):3904-3916, January 26, 1989].

A copy of the guidelines can be obtained from the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue, N.W., Room N-3101, Washington, D.C. 20210, or from the nearest OSHA Regional Office.

To be sure safety policies are implemented effectively, there must be cooperation among supervisors, employee groups, including unions, and individual employees. Each supervisor must understand the degree of responsibility and authority he or she holds in a particular area. For effective labor support, affected unions should be notified of construction plans and asked to cooperate.

It is also important, before beginning work, for employers to provide employees who are exposed to public vehicular traffic with warning vests or other suitable garments marked with or made of reflectorized or high-visibility material and ensure that they wear them. Workers must also be instructed to remove or neutralize surface encumbrances that may create a hazard.

In addition, no employee should operate a piece of equipment without first being properly trained to handle it and fully alerted to its potential hazards.

In the training and in the site safety and health program, it also is important to incorporate procedures for fast notification and investigation of accidents.

On-the-Job Evaluation

The standard requires that a competent person inspect, on a daily basis, excavations and the adjacent areas for possible cave-ins, failures of protective systems and equipment, hazardous atmospheres, or other hazardous conditions. If these conditions are encountered, exposed employees must be removed from the hazardous area until the necessary safety precautions have been taken. Inspections are also required after natural (e.g., heavy rains) or man-made events such as blasting that may increase the potential for hazards.

Larger and more complex operations should have a full-time safety official who makes recommendations to improve the implementation of the safety plan. In a smaller operation, the safety official may be part-time and usually will be a supervisor.

Supervisors are the contractor's representatives on the job. Supervisors should conduct inspections, investigate accidents, and anticipate hazards. They should ensure that employees receive on-the-job safety and health training. They should also review and strengthen overall safety and health precautions to guard against potential hazards, get the necessary worker cooperation in safety matters, and make frequent reports to the contractor.

It is important that managers and supervisors set the example for safety at the job site. It is essential that when visiting the job site, all managers, regardless of status, wear the prescribed personal protective equipment such as safety shoes, safety glasses, hard hats, and other necessary gear (see CFR 1926.100 and 102).

Employees must also take an active role in job safety. The contractor and supervisor should make certain that workers have been properly trained in the use and fit of the prescribed protective gear and equipment, that they are wearing and using the equipment correctly, and that they are using safe work practices.

Cave-Ins and Protective Support Systems

Support Systems

Excavation workers are exposed to many hazards, but the chief hazard is danger of cave-ins. OSHA requires that in all excavations employees exposed to potential cave-ins must be protected by sloping, or benching the sides of the excavation; supporting the sides of the excavation, or placing a shield between the side of the excavation and the work area.

Designing a protective system can be complex because of the number of factors involved—soil classification, depth of cut, water content of soil, changes due to weather and climate, or other operations in the vicinity. The standard, however, provides several different methods and approaches (four for sloping and four for shoring, including the use of shields)⁽¹⁾ for designing protective systems that can be used to provide the required level of protection against cave-ins.

One method of ensuring the safety and health of workers in an excavation is to slope the sides to an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal). These slopes must be excavated to form configurations that are in accordance with those for Type C soil found in Appendix B of the standard. A slope of this gradation or less is considered safe for any type of soil (see Figure

1).

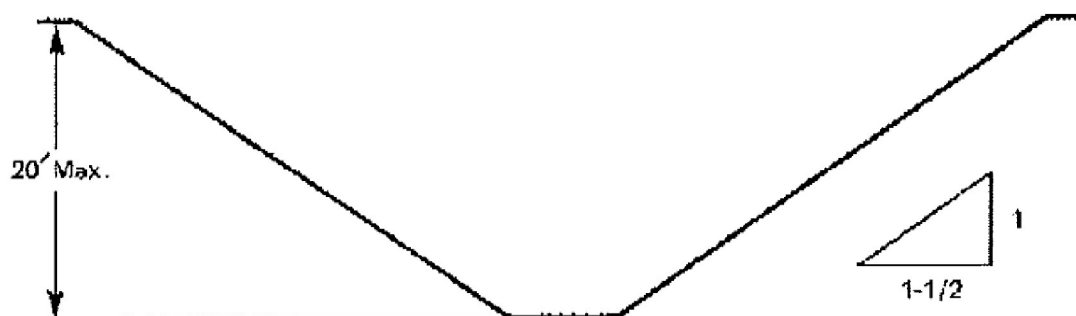


Figure 1. Excavations Made in Type C Soil

All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.

A second design method, which can be applied for both sloping and shoring, involves using tabulated data, such as tables and charts, approved by a registered professional engineer. These data must be in writing and must include sufficient explanatory information to enable the user to make a selection, including the criteria for determining the selection and the limits on the use of the data.

At least one copy of the information, including the identity of the registered professional engineer who approved the data, must be kept at the worksite during construction of the protective system. Upon completion of the system, the data may be stored away from the job site, but a copy must be made available, upon request, to the Assistant Secretary of Labor for OSHA.

Contractors also may use a trench box or shield that is either designed or approved by a registered professional engineer or is based on tabulated data prepared or approved by a registered professional engineer. Timber, aluminum, or other suitable materials may also be used. OSHA standards permit the use of a trench shield (also known as a welder's hut) as long as the protection it provides is equal to or greater than the protection that would be provided by the appropriate shoring system (see Figure 2).

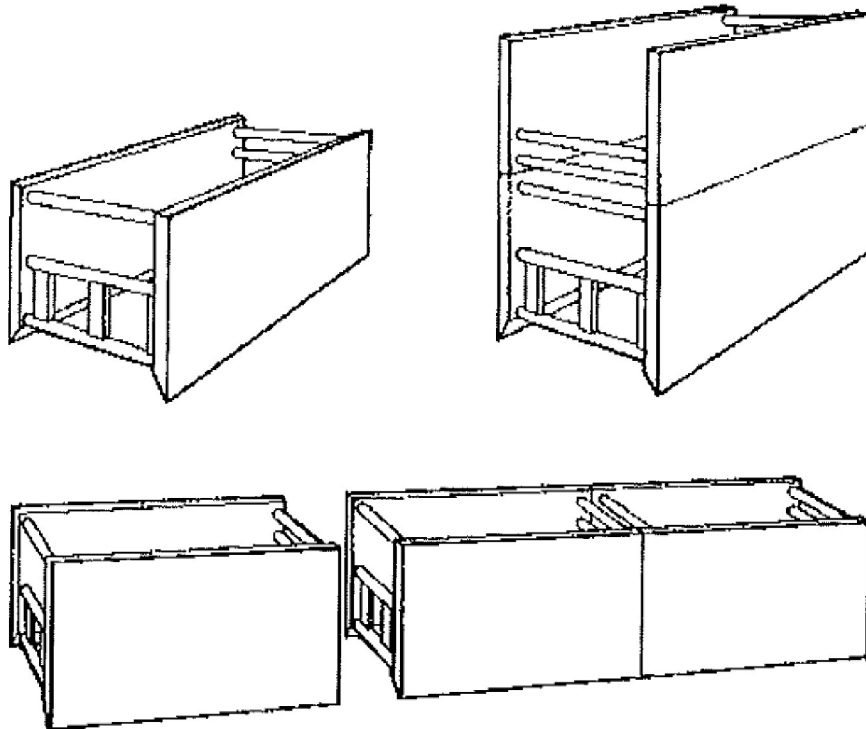


Figure 2. Trench Shields

The employer is free to choose the most practical design approach for any particular circumstance. Once an approach has been selected, however, the required performance criteria must be met by that system.

The standard does not require the installation and use of a protective system when an excavation (1) is made entirely in stable rock, or (2) is less than 5 feet deep and a competent person has examined the ground and found no indication of a potential cave-in.

Safety Precautions

The standard requires the employer to provide support systems such as shoring, bracing, or underpinning to ensure the stability of adjacent structures such as buildings, walls, sidewalks or pavements.

The standard prohibits excavation below the level of the base or footing of any foundation or retaining wall unless (1) a support system such as underpinning is provided, (2) the excavation is in stable rock, or (3) a registered professional engineer determines that the structure is sufficiently removed from the excavation and that excavation will not pose a hazard to employees.

Excavations under sidewalks and pavements are also prohibited unless an appropriately designed support system is provided or another effective method is used.

Installation and Removal of Protective Systems

The standard requires the following procedures for the protection of employees when installing support systems:

- Securely connect members of support systems,
- Safely install support systems,
- Never overload members of support systems, and

- Install other structural members to carry loads imposed on the support system when temporary removal of individual members is necessary.

In addition, the standard permits excavation of 2 feet or less below the bottom of the members of a support or shield system of a trench if (1) the system is designed to resist the forces calculated for the full depth of the trench, and (2) there are no indications, while the trench is open, of a possible cave-in below the bottom of the support system. Also, the installation of support systems must be closely coordinated with the excavation of trenches.

As soon as work is completed, the excavation should be back-filled as the protective system is dismantled. After the excavation has been cleared, workers should slowly remove the protective system from the bottom up, taking care to release members slowly.

Materials and Equipment

The employer is responsible for the safe condition of materials and equipment used for protective systems. Defective and damaged materials and equipment can result in the failure of a protective system and cause excavation hazards.

To avoid possible failure of a protective system, the employer must ensure that (1) materials and equipment are free from damage or defects, (2) manufactured materials and equipment are used and maintained in a manner consistent with the recommendations of the manufacturer and in a way that will prevent employee exposure to hazards, and (3) while in operation, damaged materials and equipment are examined by a competent person to determine if they are suitable for continued use. If materials and equipment are not safe for use, they must be removed from service. These materials cannot be returned to service without the evaluation and approval of a registered professional engineer.

Other Hazards

Falls and Equipment

In addition to cave-in hazards and secondary hazards related to cave-ins, there are other hazards from which workers must be protected during excavation-related work. These hazards include exposure to falls, falling loads, and mobile equipment. To protect employees from these hazards, OSHA requires the employer to take the following precautions:

- Keep materials or equipment that might fall or roll into an excavation at least 2 feet from the edge of excavations, or have retaining devices, or both.
- Provide warning systems such as mobile equipment, barricades, hand or mechanical signals, or stop logs, to alert operators of the edge of an excavation. If possible, keep the grade away from the excavation.
- Provide scaling to remove loose rock or soil or install protective barricades and other equivalent protection to protect employees against falling rock, soil, or materials.
- Prohibit employees from working on faces of sloped or benched excavations at levels above other employees unless employees at lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.
- Prohibit employees under loads that are handled by lifting or digging equipment. To avoid being struck by any spillage or falling materials, require employees to stand away from vehicles being loaded or unloaded. If cabs of vehicles provide adequate protection from falling loads during loading and unloading operations, the operators may remain in them.

Water Accumulation

The standard prohibits employees from working in excavations where water has accumulated or is accumulating unless adequate protection has been taken. If water removal equipment is used to control or prevent water

from accumulating, the equipment and operations of the equipment must be monitored by a competent person to ensure proper use.

OSHA standards also require that diversion ditches, dikes, or other suitable means be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Also, a competent person must inspect excavations subject to runoffs from heavy rains.

Hazardous Atmospheres

Under this provision, a competent person must test excavations greater than 4 feet in depth as well as ones where oxygen deficiency or a hazardous atmosphere exists or could reasonably be expected to exist, before an employee enters the excavation. If hazardous conditions exist, controls such as proper respiratory protection or ventilation must be provided. Also, controls used to reduce atmospheric contaminants to acceptable levels must be tested regularly.

Where adverse atmospheric conditions may exist or develop in an excavation, the employer also must provide and ensure that emergency rescue equipment, (e.g., breathing apparatus, a safety harness and line, basket stretcher, etc.) is readily available. This equipment must be attended when used.

When an employee enters bell-bottom pier holes and similar deep and confined footing excavations, the employee must wear a harness with a lifeline. The lifeline must be securely attached to the harness and must be separate from any line used to handle materials. Also, while the employee wearing the lifeline is in the excavation, an observer must be present to ensure that the lifeline is working properly and to maintain communication with the employee.

Access and Egress

Under the standard, the employer must provide safe access and egress to all excavations. According to OSHA regulations, when employees are required to be in trench excavations 4-feet deep or more, adequate means of exit, such as ladders, steps, ramps or other safe means of egress, must be provided and be within 25 feet of lateral travel. If structural ramps are used as a means of access or egress, they must be designed by a competent person if used for employee access or egress, or a competent person qualified in structural design if used by vehicles. Also, structural members used for ramps or runways must be uniform in thickness and joined in a manner to prevent tripping or displacement.

SUMMARY

Trenching and excavation work presents serious risks to all workers involved. The greatest risk, and one of primary concern, is that of a cave-in. Furthermore, when cave-in accidents occur, they are much more likely to result in worker fatalities than other excavation-related accidents. Strict compliance, however, with all sections of the standard will prevent or greatly reduce the risk of cave-ins as well as other excavation-related accidents.

Regulations (Standards - 29 CFR)

Sloping and Benching - 1926 Subpart P App B

☐ Regulations (Standards - 29 CFR) - Table of Contents

• Part Number:	1926
• Part Title:	Safety and Health Regulations for Construction
• Subpart:	P
• Subpart Title:	Excavations
• Standard Number:	1926 Subpart P App B
• Title:	Sloping and Benching

(a) **Scope and application.** This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) **Definitions.**

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) **Requirements** -- (1) **Soil classification.** Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) **Maximum allowable slope.** The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) **Actual slope.** (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least $\frac{1}{2}$ horizontal to one vertical ($\frac{1}{2}H:1V$) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(l).

(4) **Configurations.** Configurations of sloping and benching systems shall be in accordance with Figure B-1.

**TABLE B-1
MAXIMUM ALLOWABLE SLOPES**

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90°)
TYPE A (2)	$3/4:1$ (53°)
TYPE B	$1:1$ (45°)
TYPE C	$1\frac{1}{2}:1$ (34°)

Footnote(1) Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

Footnote(2) A short-term maximum allowable slope of $1/2H:1V$ (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be $3/4H:1V$ (53°).

Footnote(3) Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

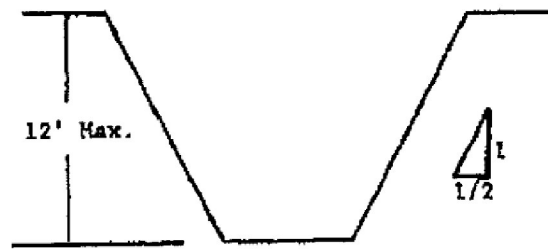
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of $3/4:1$.



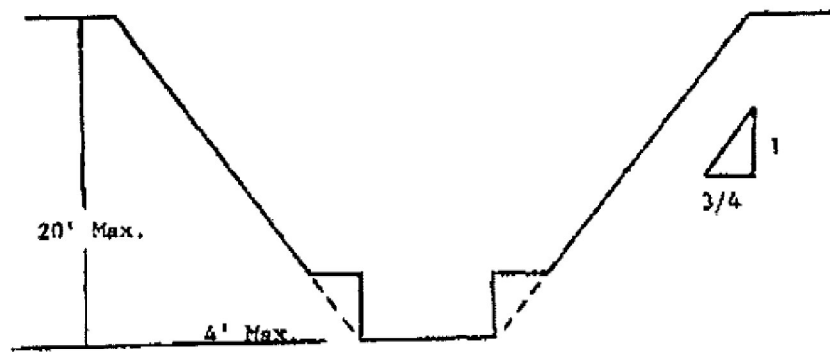
SIMPLE SLOPE -- GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of $\frac{1}{2}$:1.

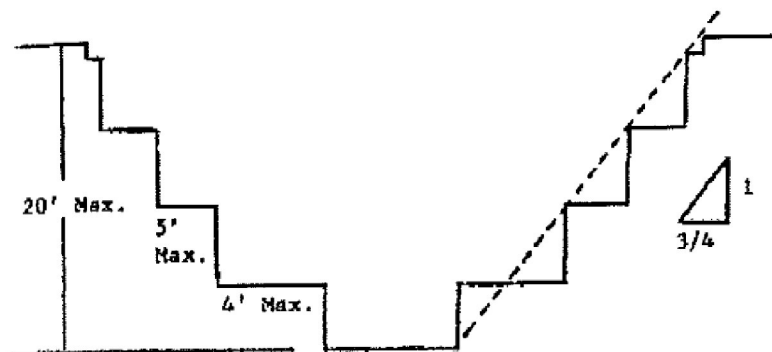


SIMPLE SLOPE -- SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of $\frac{3}{4}$ to 1 and maximum bench dimensions as follows:



SIMPLE BENCH



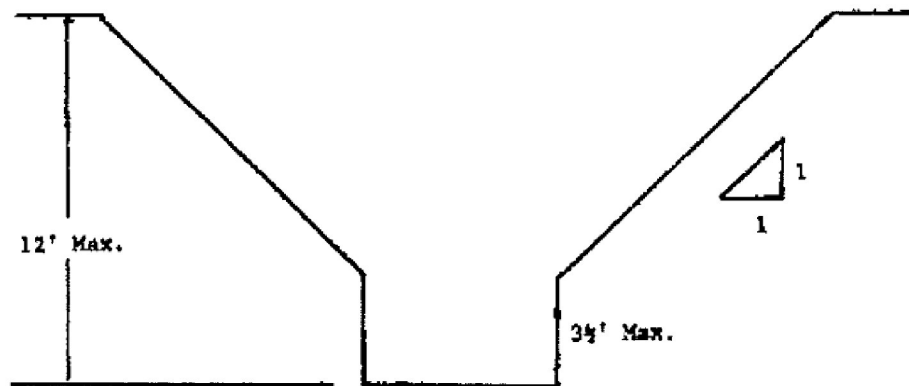
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of $3\frac{1}{2}$ feet.



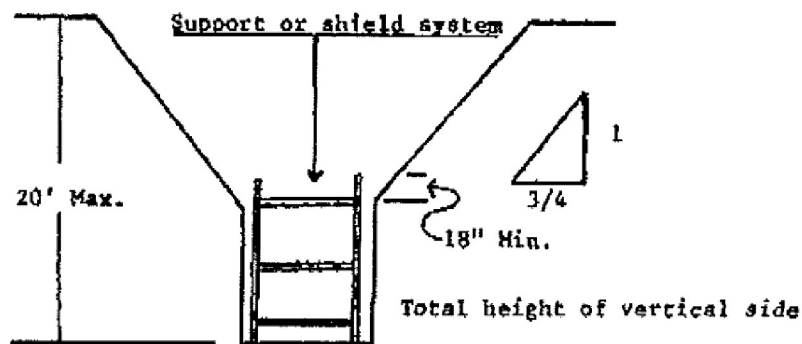
UNSUPPORTED VERTICALLY SIDED LOWER PORTION -- MAXIMUM 8 FEET IN DEPTH)

All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



UNSUPPORTED VERTICALLY SIDED LOWER PORTION -- MAXIMUM 12 FEET IN DEPTH)

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

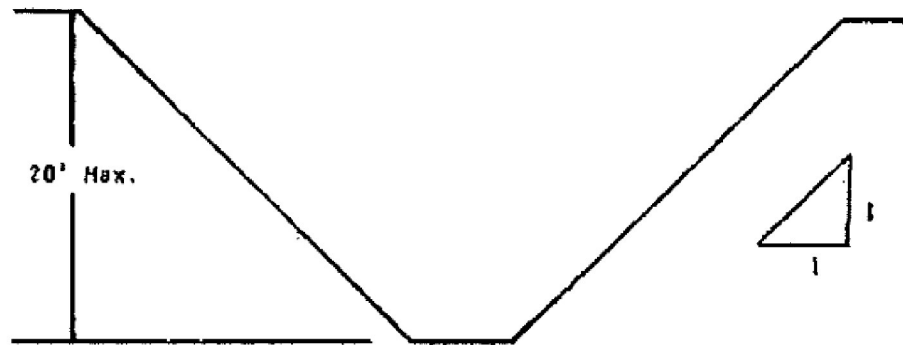


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under § 1926.652(b).

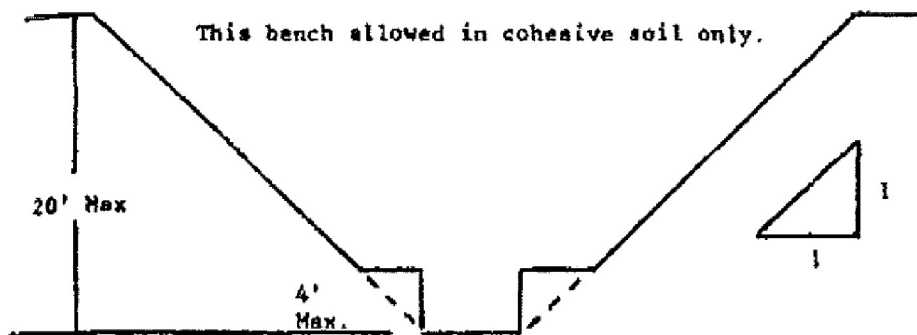
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

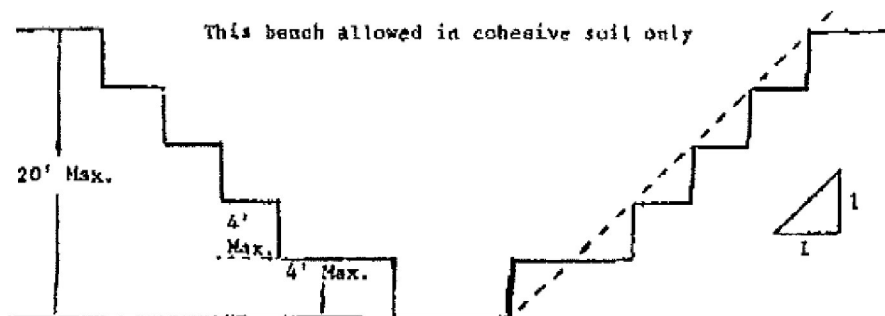


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

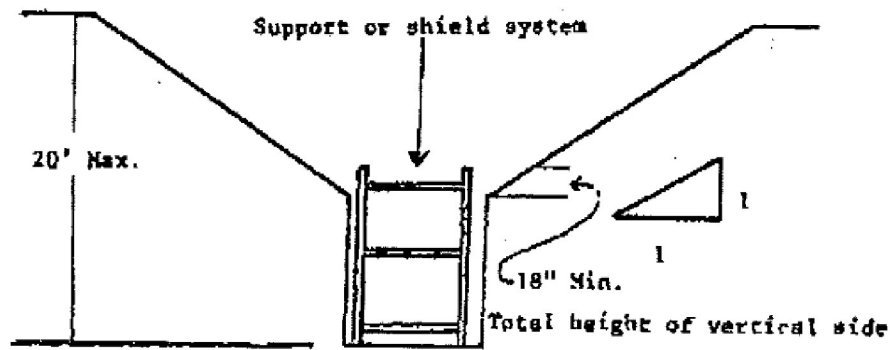


SINGLE BENCH



MULTIPLE BENCH

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

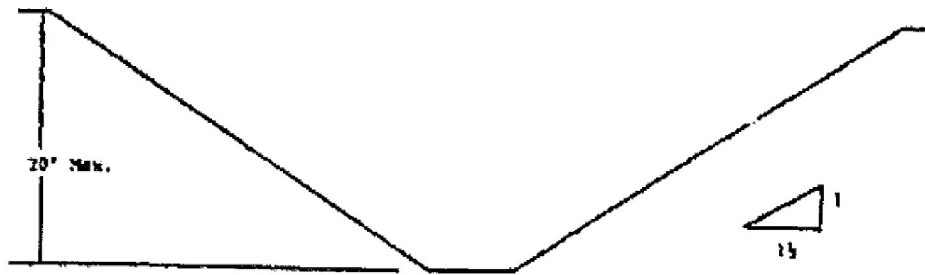


VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

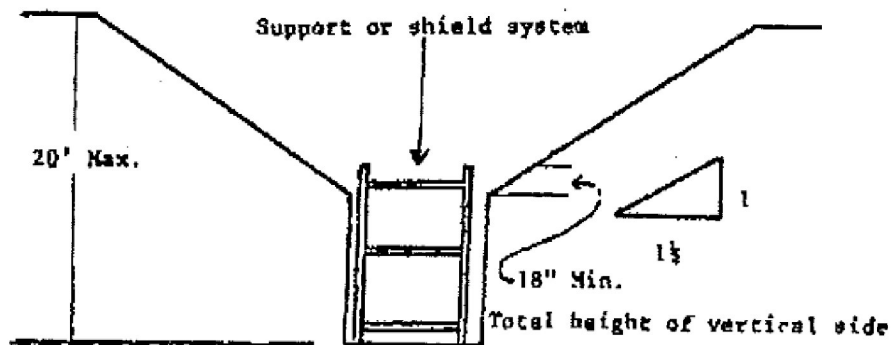
B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of $1\frac{1}{2}:1$.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of $1\frac{1}{2}:1$.



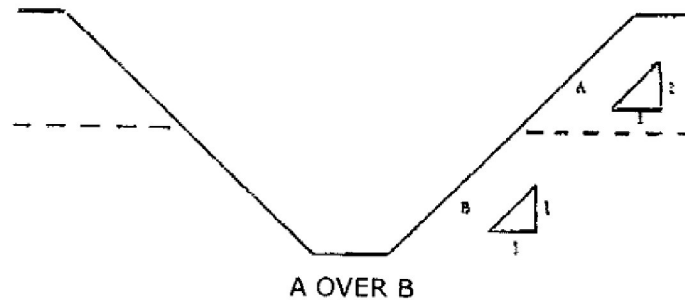
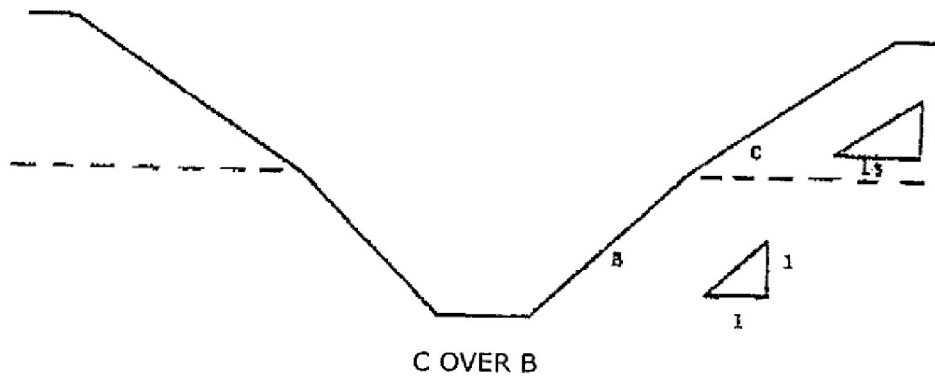
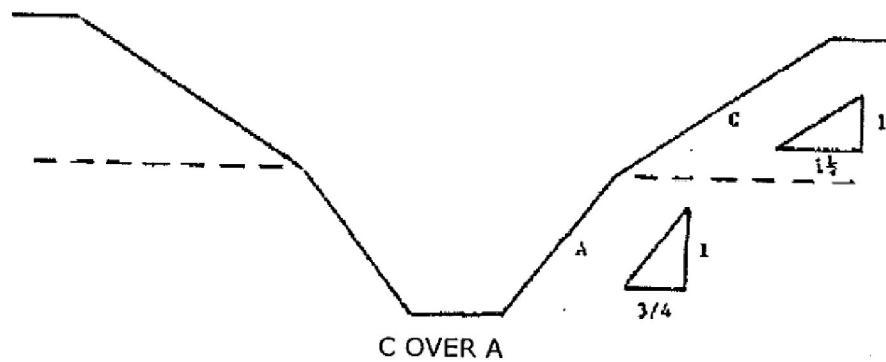
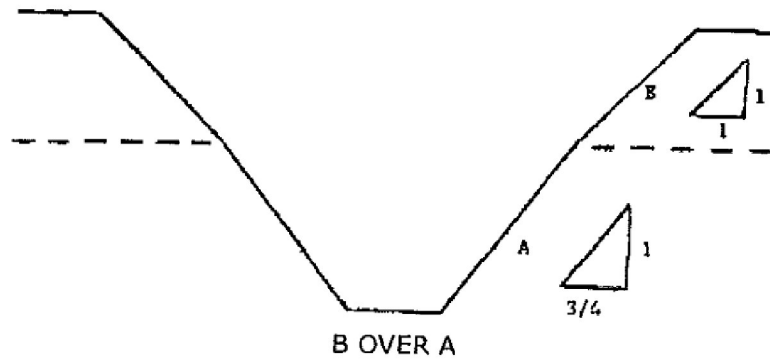
VERTICAL SIDED LOWER PORTION

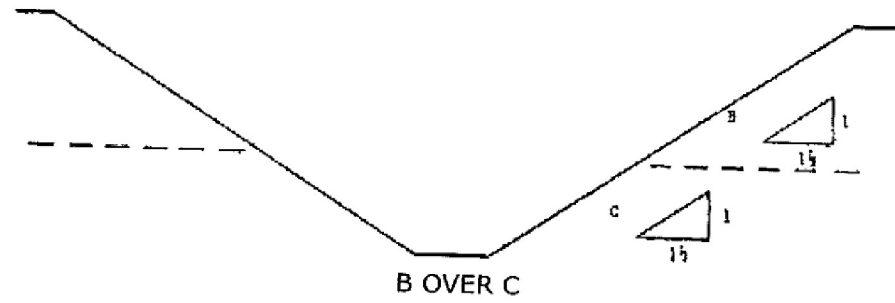
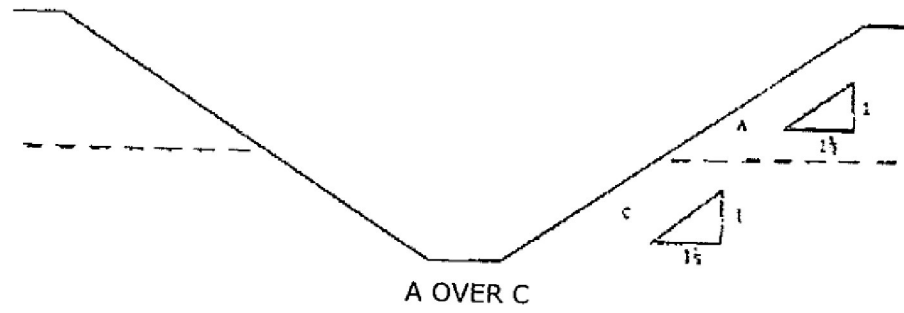
3. All other sloped excavations shall be in accordance with the other options permitted in §

1926.652(b).

B-1.4 Excavations Made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.





2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

PARPCPTAS-013

Tomado de: http://www.osha.gov/doc/highway_workzones/mutcd/6c_temporary.html

Manual on Uniform Traffic Control Devices (MUTCD): Temporary Traffic Control Elements

C. TEMPORARY TRAFFIC CONTROL ELEMENTS

6C-1. TRAFFIC CONTROL PLANS

Traffic Control Plans (TCP's) play a vital role in providing continuity of safe and efficient traffic flow, to the extent interruptions in normal flow are necessary for temporary traffic control operations or other events that must temporarily disrupt normal traffic flow. Important auxiliary provisions that cannot conveniently be specified on project plans can easily be incorporated into Special Provisions within the TCP.

A TCP describes traffic controls to be used for facilitating vehicle and pedestrian traffic through a temporary traffic control zone. The plan may range in scope from being very detailed, to merely referencing typical drawings contained in the MUTCD, standard approved highway agency drawings and manuals, or specific drawings contained in contract documents. The degree of detail in the TCP depends entirely on the complexity of the situation, and TCP's should be prepared by persons knowledgeable about the fundamental principles of temporary traffic control and the work activities to be performed.

Traffic control planning requires forethought. Provisions may be incorporated into the project bid documents that enable contractors to develop alternate traffic control plans, which may be used only if the responsible agency finds they are as good as those provided in the plans/specifications. For maintenance and minor utility projects that do not require bidding, forethought must be given to selecting the best traffic control before occupying the temporary traffic control zone. Also, coordination must be made between projects to ensure that duplicate signing is not used and to ensure compatibility of traffic control between adjacent projects.

Modifications of TCP's may be necessary because of changed conditions or determination of even better ways of handling traffic safely and efficiently, while permitting efficient temporary traffic control activities to progress.

6C-2. DEFINITION OF TEMPORARY TRAFFIC CONTROL ZONE COMPONENTS

The temporary traffic control zone includes the entire section of roadway between the first advance warning sign through the last traffic control device, where traffic returns to its normal path and conditions. Most temporary traffic control zones can be divided into four areas: the advance warning area, the transition area, the activity area, and the termination area. Figure VI-1 illustrates these four areas. The four components that constitute a temporary traffic control zone are described in the order that drivers encounter them. They include the following:

a. *Advance Warning Area*

In the advance warning area, drivers are informed of what to expect. The advance warning may vary from a single sign or flashing lights on a vehicle to a series of signs in advance of the temporary traffic control zone transition area. On freeways and expressways, where driver speed is generally in the higher range (45 mph or more), signs may be placed from 500 feet to 1/2 mile or more before the temporary traffic control zone. The true test of adequacy of sign spacing is to evaluate how much time the driver has to perceive and react to the condition ahead. In this regard, the use of speed, roadway condition, and related driver expectancy must be considered in order to derive a practical sign spacing distance. As a guide, table II-1 in section 2C-3 should be used in conjunction with consideration of actual or anticipated field conditions. Effective placement of warning signs for urban and rural locals is as follows:

(1) *Urban*

Warning sign spacing in advance of the transition area normally range from four to eight times the speed (mph) in feet, with the high end of the range being used when speeds are relatively high. When single advance warning signs are used (as in the case of low-speed residential streets), the advance warning area can be as short as 200 feet. When two or more advance signs are used on higher-speed streets such as major arterials, the advance warning area should extend a greater distance. (See table VI-3.)

(2) *Rural*

Rural roadways are characterized by higher speeds. Spacing for the placement of warning signs is substantially longer—from 8 to 12 times the speed (mph) in feet. Two or more advance warning signs are normally used in these conditions, the advance warning area should extend 1,500 feet or more in open highway conditions. (See table VI-3.)

Advance warning is normally not needed when the activity area is sufficiently removed from the driver's path that it does not interfere with traffic.

b. *Transition Area*

When redirection of the driver's normal path is required, traffic must be channelized from the normal path to a new path. This redirection is intended to occur at the beginning of the transition area. In mobile operations, this transition area moves with the work space. Transition areas usually involve strategic use of tapers, which (because of their importance) are discussed in more detail in section 6C-3.

c. *Activity Area*

The activity area is an area of roadway where the work takes place. It is composed of the work space and the traffic space, and may contain one or more buffer spaces.

(1) *Work Space*

The work space is that portion of the roadway closed to traffic and set aside for workers, equipment, and material. Work space may be fixed or may move as work progresses. Long-term work spaces are usually delineated by channelizing devices or shielded by barriers to exclude traffic and pedestrians.

(2) *Traffic Space*

The traffic space is the portion of the roadway in which traffic is routed through the activity area.

(3) *Buffer Space*

The buffer space is an optional feature in the activity area that separates traffic flow from the work activity or a potentially hazardous area and provides recovery space for an errant vehicle. Neither work activity nor storage of equipment, vehicles, or material should occur in this space. Buffer spaces may be positioned longitudinally and laterally, with respect to the direction of traffic flow.

(a) *Longitudinal Buffer Space*

The longitudinal buffer space may be placed in the initial portion of a closed lane in advance of the work space, as shown in figure VI-1. When a protection vehicle is placed in advance of the work space, only the space upstream of the vehicle constitutes the buffer space.

The longitudinal buffer space, as depicted in figure VI-2, should be used where a closed lane separates opposing traffic flows. Typically, it is formed as a traffic island and defined by channelizing devices.

A guide for the length of longitudinal buffer space is shown in table VI-1. The length may be adjusted to satisfy individual agency needs.

(b) *Lateral Buffer Space*

A lateral buffer space may be used to separate the traffic space from the work space, as shown in figure VI-1, or a potentially hazardous area, such as an excavation or pavement drop-off. A lateral buffer space also may be used between two travel lanes, especially those carrying opposing flows. The width of the lateral buffer space should be determined by engineering judgment.

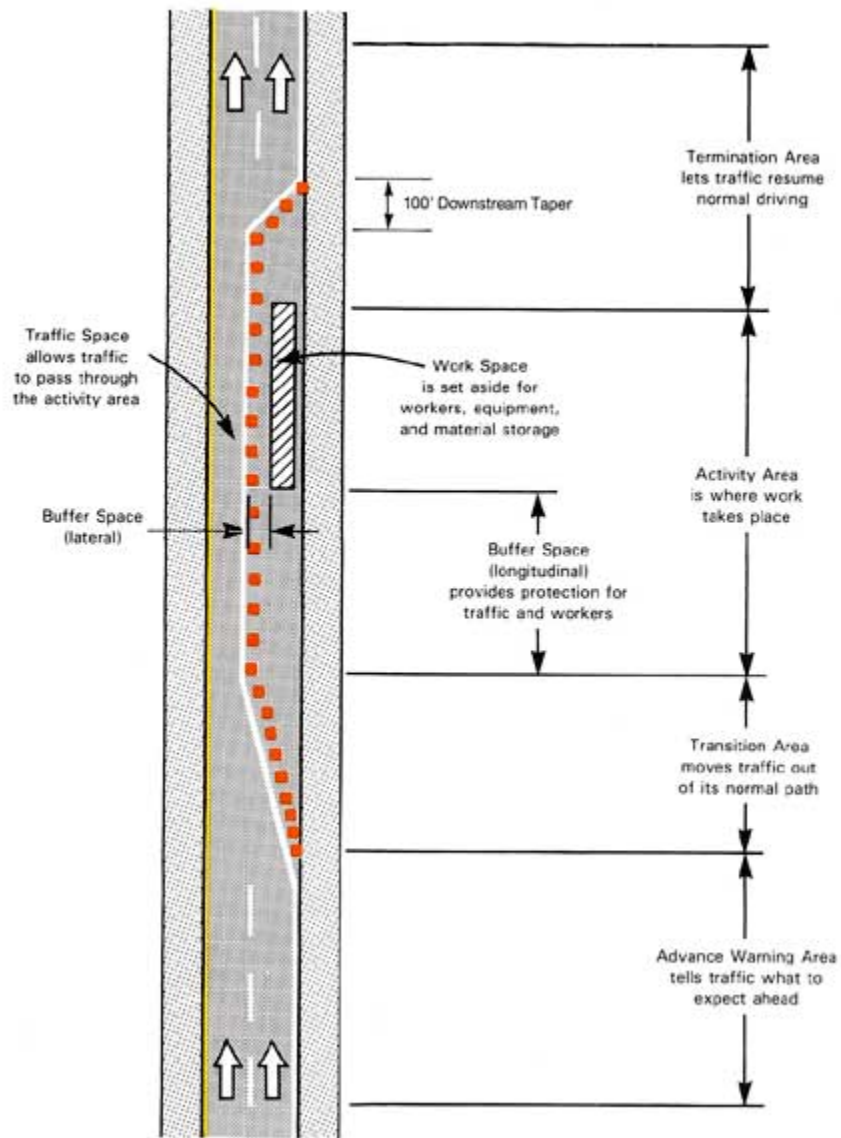


Figure VI-1. Component parts of a temporary traffic control zone.

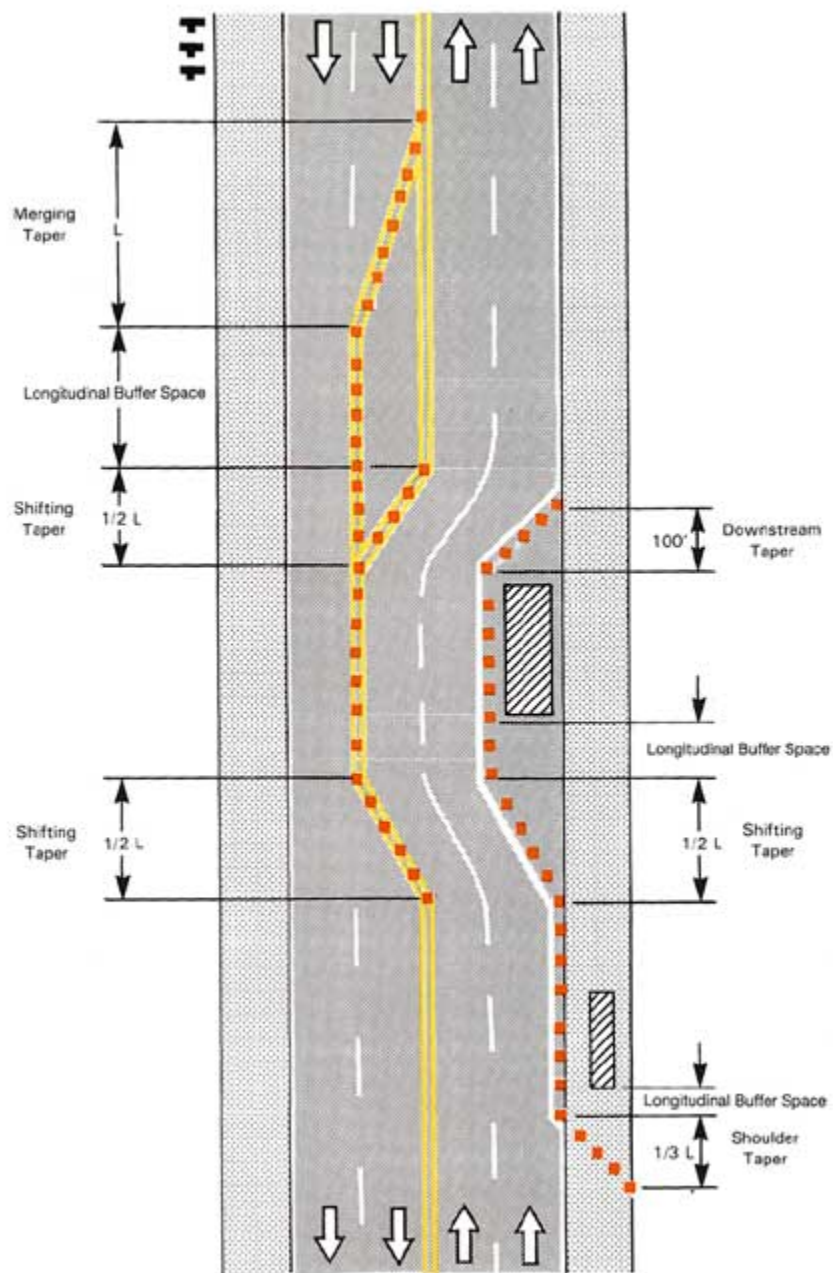


Figure VI-2. Tapers and buffer space.

Table VI-1. Guidelines for length of longitudinal buffer space¹

Speed* (mph)	Length (feet)
20	35
25	55
30	85
35	120
40	170
45	220
50	280
55	335
60	415
65	485

* Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.

¹Based upon American Association of State Highway and Transportation Officials (AASHTO) braking distance portion of stopping sight distance for wet and level pavements (A Policy on Geometric Design of Highways and Streets, AASHTO, 1990, p. 120). This AASHTO document also recommends adjustments for the effect Of grade on stopping and variation for trucks.

(4) Incident Management Vehicle Storage Space

When work occurs on a high-volume, highly congested facility in an urban area, it is optional to allow space to store emergency vehicles (e.g., tow trucks) to respond quickly to traffic incidents. The storage space is typically provided at the beginning or end of the activity area, or both. An emergency vehicle storage area should not extend into any portion of the buffer space.

d. *Termination Area*

The termination area is used to return traffic to the normal traffic path. The termination area extends from the downstream end of the work area to the END ROAD WORK signs, if posted. Conditions may be such that posting of END ROAD WORK signs is not helpful. For example, the END ROAD WORK signs should normally not be used if other temporary traffic control zones begin within a mile of the end of the work space in rural areas, or about a quarter-mile within urban areas. For normal daytime maintenance operations, the END ROAD WORK SIGN is optional.

6C-3. TAPERS

A common important element of a temporary traffic control zone is a roadway taper. Tapers may be used in both the transition and termination areas. Tapers are created using a series of channelizing devices or pavement markings placed to move traffic out of or into its normal path. Whenever tapers are to be used near interchange ramps, crossroads, curves, or other influencing factors, it may be desirable to adjust the length of tapers. Longer tapers are not necessarily better than shorter tapers (particularly in urban areas characterized by short block lengths, driveways, etc.) , because extended tapers tend to encourage sluggish operation and to encourage drivers to delay lane changes unnecessarily. The real test of taper length involves observation of driver performance after traffic control plans are put into effect. Types of taper lengths are presented in table VI-2. The maximum space between devices in a taper normally approximates the distance in feet of the speed in miles per hour (i.e.: a 55 mph speed road should normally have devices spaced about 55 feet apart). Types of tapers are shown in figure VI-2 and the two-way traffic taper is shown in figure VI-3:

Table VI-2. Taper length criteria for temporary traffic control zones

Type of taper	Taper length
Upstream tapers	
Merging taper	L minimum
Shifting taper	1/2 L minimum
Shoulder taper	1/3 L minimum
Two-way traffic taper	100 feet maximum
Downstream tapers	100 feet minimum
(use is optional)	
Formulas for L*	
Speed	Formula
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or greater	$L = W \times S$

*L = Taper length in feet.

W = Width of offset in feet.

S = Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.

a. *Merging Taper*

A merging taper requires the longest distances because drivers are required to merge with an adjacent lane of

traffic at the prevailing speed. The taper should be long enough to enable merging drivers to adjust their speeds and merge into a single lane before the end of the transition. For freeways, expressways, and other roadways having a speed of 45 mph or greater, the minimum length for merging tapers should be computed by a formula $L = W \times S$. For residential, urban, and other streets with speeds less than 45 mph, the formula $L = (W \times S^2)/60$ should be used. Under either formula, L is the taper length in feet, W is the lateral shift of traffic due to the partially or fully closed lane (in feet), and S is the posted speed, the off-peak 85th percentile speed prior to work starting or the anticipated operating speed. The formula $L = (W \times S^2)/60$ is used for speeds less than 45 mph because slower traffic can merge safely in a shorter distance.

b. *Shifting Taper*

A shifting taper is used when merging is not required, but a lateral shift is needed. Approximately one-half L has been found to be adequate. Where more space is available, it may be beneficial to use longer distances. Guidance for changes in alignment may also be accomplished by using horizontal curves designed for normal highway speeds.

c. *Shoulder Taper*

A shoulder taper may be beneficial on high-speed roadways with improved shoulders that may be mistaken for driving lanes (when work is occurring in the shoulder area). If used, shoulder tapers approaching the activity area should have a length of about one-third L. If a shoulder is used as a travel lane either through practice or during a temporary traffic activity, a normal merging or shifting taper should be used. An example of a shoulder taper is presented in figure VI-2.

d. *Downstream Taper*

The downstream taper may be useful in termination areas to provide a visual cue to the driver that access is available to the original lane/path that was closed. When a downstream taper is used, it should have a minimum length of about 100 feet per lane, with devices spaced about 20 feet apart. An example of a downstream taper is shown in figure VI-2.

e. *One-Lane, Two-Way Taper*

The one-lane, two-way traffic taper is used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction. Typically, traffic is controlled by a temporary traffic signal or a flagger. A short taper having a maximum length of 100 feet with channelizing devices at approximately 20-foot spacings should be used to guide traffic into the one-way section. An example of a one-lane, two-way traffic taper is presented in figure VI-3.

6C-4. DETOURS AND DIVERSIONS

At detours, traffic is directed onto another roadway to bypass the temporary traffic control zone. Detours should be signed clearly over their entire length so that motorists can easily determine how to return to the original roadway.

At diversions, traffic is directed onto a temporary roadway or alignment placed in or next to the right-of-way, e.g., median crossovers or lane shifts.

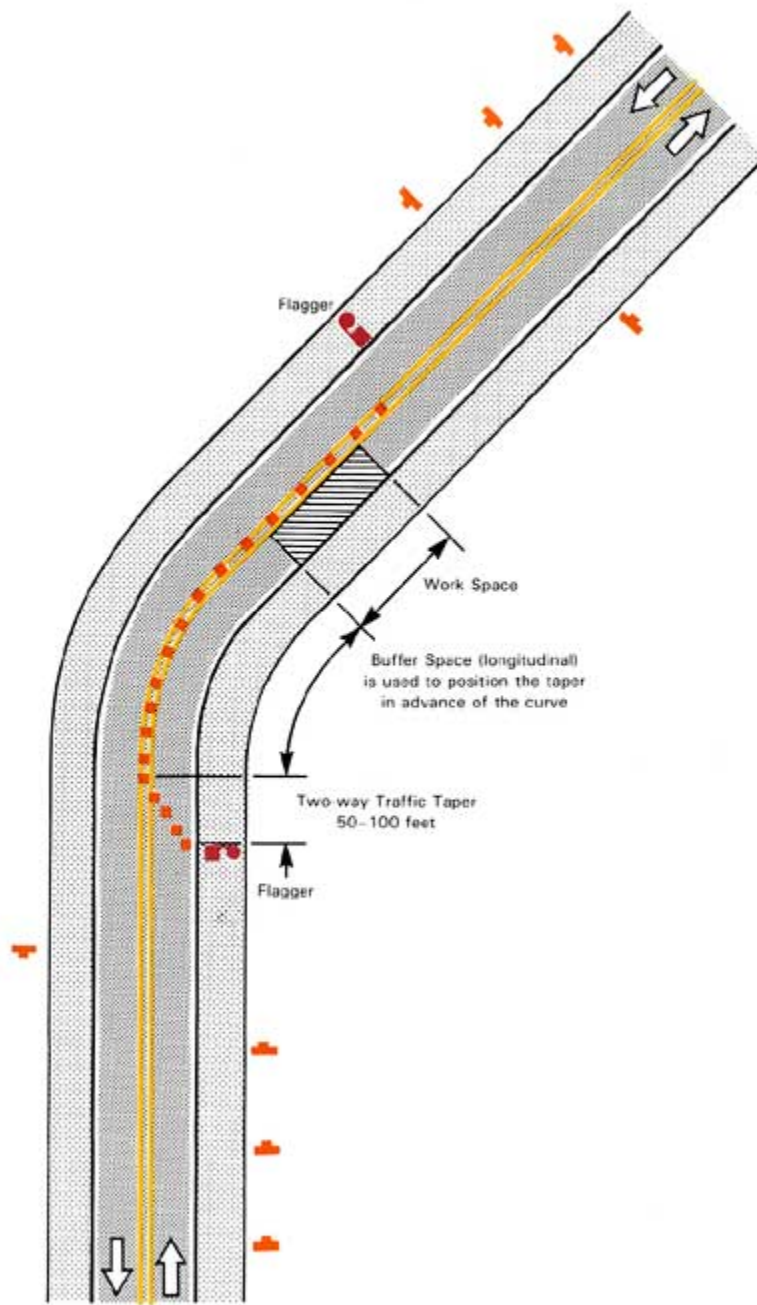


Figure VI-3. Example of one lane-two way traffic control.
6C-5. ONE-LANE, TWO-WAY TRAFFIC CONTROL

Where traffic in both directions must, for a limited distance, use a single lane, provision should be made for alternate one-way movement through the constricted section. Some means of coordinating movements at each end shall be used to avoid head-on conflicts and to minimize delays. Control points at each end should be chosen to permit easy passing of opposing lines of vehicles. At a "spot" obstruction, however, such as an isolated pavement patch on roadways with lower speeds and adequate sight distance, the movement may be self-regulating.

Alternate one-way traffic control may be accomplished as appropriate by flagger control, a flag-carrying or official car, a pilot car, traffic signals, or by using stop or yield control. This section discusses each of these traffic control techniques. (See section 6E-2 for flagger qualifications.)

a. *Flagger Method*

Where a one-lane two-way temporary traffic control zone is short enough to allow visibility from one end to the other, traffic may be controlled by either a single flagger or by a flagger at each end of the section. When a single flagger is used, the flagger should be stationed on the shoulder opposite the obstruction or work space, or in a position where good visibility and traffic control can be maintained at all times. When good visibility and traffic control cannot be maintained by one flagger station, traffic may be controlled by a flagger at each end of the

section. One of the flaggers should be designated as the coordinator. Flaggers should be able to communicate orally or with signals. These signals should not be mistaken for flagging signals. The use of radios may also be desirable even though visual contact is possible.

b. *Flag Transfer Method*

Flag carrying is effective when the route is well defined. It should be employed only when the one-way traffic is confined to a relatively short length of road, usually not more than 1 mile in length.

The driver of the last vehicle proceeding into the one-lane section is given a red flag (or other token) and instructed to deliver it to the flagger at the other end. The opposite flagger, upon receipt of the flag, then knows that it is safe to allow traffic to move in the other direction. The flag being carried should always be clean and dry. A variation of this method is the use of an "official" car that always follows the last vehicle proceeding through the section. The use of an official car eliminates the possibility of loss of the flag.

c. *Pilot Car Method*

A pilot car is used to guide a queue of vehicles through a normally complex temporary traffic control zone or detour. Its operation must be coordinated with flagging operations or other controls at each end of the one-lane section.

The pilot car should have the name of the contractor or contracting authority prominently displayed. The PILOT CAR sign (G20-4) shall be mounted at a conspicuous location on the rear of the vehicle.

Two or more pilot cars may be used to guide two-way traffic through a particularly complex detour.

d. *Temporary Traffic Signal Method*

Traffic signals may be used to control vehicular traffic movements in temporary traffic control zones. Traffic signals should also be considered for half-width bridge reconstruction on low- to moderate-volume highways. Typical applications include highway or street intersections with a temporary haul road or equipment crossing and through areas requiring alternating one-way traffic operations.

e. *Stop or Yield Control Method*

A yield or stop sign may be installed on low- volume, two-lane roads where one side of the roadway is closed and the other side must serve both directions. The side that is closed should yield to or stop for oncoming traffic on the side that is open. The approach to the side that is not closed must be visible (for a distance equal to the safe-passing sight distance for that approach) to the driver who must yield or stop. See section 3B-5, Warrants for No-Passing Zones at Curves.

6C-6. TRANSIT CONSIDERATIONS

Provision for effective continuity of transit service needs to be incorporated into the temporary traffic control planning process. Oftentimes, public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). On transit routes, the TCP shall provide for features such as temporary bus stops, pull-outs, and waiting areas for transit patrons.



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Área de Calidad de Agua

División de Control de Tanques de Almacenamiento Soterrados



PARPCPTAS-014

**FORMATO PARA LAS ACCIONES CORRECTIVAS Y PREVENTIVAS
CARS "Corrective Action Report System".**

ACCION

☐ Correctiva ☐ Preventiva

Fecha:

Área:

Origen del Problema (No Conformidad)

Auditoria de Calidad _____

- ☐ Requerimientos de QA/QC _____
- ☐ Problemas con Instrumentación _____
- ☐ Sugerencias Internas _____
- ☐ Visitas Gerenciales, Seguimiento _____
- ☐ Otras fuentes de información (explique) _____

Descripción del Problema (No Conformidad)

Identificación de la Causa del Problema

Acción Correctiva

CERTIFICACION

Nombre persona responsable de investigación:

Firma Persona Responsable de la Investigación:

Fecha de Implantación de Acción Correctiva:

Nombre y Firma del Gerente del Área:

Fecha:

SEGUIMIENTO A LA IMPLANTACIÓN DE ACCIONES CORRECTIVAS Y PREVENTIVAS

Fecha:	
Nombre de quien verifica:	
Fue implantada?	<input type="checkbox"/> Si <input type="checkbox"/> No
Comentarios:	
Firma de quien verifica:	
Firma del Gerente:	
Fecha:	

Definiciones:

- **No Conformidad = incumplimiento de los requisitos.**
- **Acciones Correctivas = conjunto de acciones tomadas para eliminar las causas de un incumplimiento y evitar que se repita nuevamente.**
- **Acción Preventiva = conjunto de acciones tomadas para eliminar las causas de un incumplimiento potencial destinado a identificar oportunidades de mejora.**